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for

A FILTER DEVICE FOR FILTERING A LIQUID

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A FILTER DEVICE FOR FILTERING A LIQUID

FIELD OF THE INVENTION

The present invention relates in general to the field of filter devices for filtering liquids containing particulate matters, more specifically waste water. More particularly, it concerns a filter unit for use in a filter housing adapted to be mounted at the outlet of a septic tank. It also concerns a combination of a filter unit with a filter housing suitable for use in a septic tank, such combination being hereinafter called a prefilter.

BACKGROUND OF THE INVENTION

The development of prefilters to favour the retention of solid matters inside septic tanks goes back about 40 years (US patent no. 2 900 084). Such prefilters have spread during the last 20 years, and more particularly during the last 10 years. As an illustration, many American states legally require the installation of prefilters at the outlet of the tanks, in order to limit the charge of particulate matters to be treated at the purifying element following the septic tank.

Already known in the prior art, there are prefilters composed of one or many hollow vertical elements of various forms perforated with openings or slits and enclosed in a housing having an inlet for receiving the waste water and an outlet connected to the outlet of the septic tank in order to allow the evacuation of the filtered water. Examples of such prior art prefilters are given in US 4,439,323; US 5,492,635; US 5,580,453; US 5,382,357; and US 5,482,621. Usually, these prefilters do not provide decantation and/or coalescence phenomenon of the finer particles. The retention is thus assured essentially by the chosen size of the openings whether they be orifices or slits. The feed of these vertical filtering structures can be done from the interior of the element towards the exterior or from the exterior towards the interior, depending on the selected hydraulic flow model. The recourse to such hollow vertical structures favours a partial detachment of the biomass but requires either a filtering element of large dimension, as disclosed in US 4,439,323 or the multiplication of the number of filtering elements, as disclosed in US 5,492,635, and US 5,580,453. If this is not the case, the total available filtration area requires more than one cleaning per year for residences producing a discharge corresponding to an occupation of more than four people.

Also known in the prior art, there are the prefilters of the type disclosed in US 4,710,295 which include a plurality of stacked horizontally extending disc-dam units mounted in vertical in a housing. Each disc is equipped with finger shaped appendices or diverticulums formed by a continuous dam wall that follows a sinuous path and whose top side is open. The superposition and the alignment of the discs by ensuring a spacing between them, helps create a first filtration linear interstice and the sinuous dam-wall creates a second filtration interstice. Therefore, for a given volume, it is possible to increase the available interstitial surface in comparison with the one corresponding to the sum of the set of slits or perforated orifices in a hollow vertical element as described above. In such prefilters, the water to be filtered enters the housing and flows upwardly in vertical channels and then in the horizontal channels formed between each disc where it is filtered. Thus, the control of the particles to be retained is done first at the first filtration interstice. The water then flows horizontally and is further filtered by the dam wall. Usually, the larger particles are retained on the outside of the disc-dam unit and the finer particles have the possibility of decanting in the zone between two horizontal discs leading to the outlet zone.

One drawback encountered with such prefilters is that with time, the accumulation of fine particles and the formation of a biological film between the horizontal discs creates hydraulic restrictions that favour a detachment of the accumulated matters towards the effluent of the septic tank and ultimately requires a cleaning. Cleaning a structure of this type is tedious and may require a complete dismantling of the different elements.

Furthermore, although such prefilters offer a better efficiency than what was known previously, one goal in this field is still to uncover or develop a prefilter being the least voluminous possible and which can offer the maximum filtration capacity.

Therefore, there is still a need at the present time for a filter with a higher efficiency than the existing filters.

Other examples of prior art filter apparatuses for waste water are given in: CA 2,135,937; US 3,332,552; US 5,582,716; US 5,593,584; and US 5,683,577.

SUMMARY OF THE INVENTION

An object of the present invention is to propose a filter unit that satisfies the above-mentioned need.

According to the present invention, that object is achieved with a filter unit suitable for use in a filter housing. The filter unit comprises superposed and spaced-apart inclined lamellar structures each having a lower end side opposite an upper end side; and a passage for a flow of liquid between each two of the lamellar structures. Each passage has an inlet for receiving an inflow of liquid to be filtered and an outlet for discharging an outflow of filtered liquid. The filter unit further comprises filtering means in each of the passages for obstructing the flow of liquid and retaining particulate matter contained in the liquid. Mounting means for mounting the filter unit vertically in the filter housing are also provided.

Advantageously, the inclined configuration of the lamellar structure allows an increase of the filtration capacity of the filter unit in comparison to a filter unit composed of flat structures, such as described in the American patents nos. 2,900,084; 3,332,552; 4,710,295; 5,582,716; and 5,593,584.

The present invention is also directed to a combination of a filter unit as described above with a filter housing, such combination being hereinafter referred to as a prefilter. The filter housing of the prefilter has an inlet in a bottom portion thereof for receiving an inflow of liquid to be filtered and an outlet in a top portion thereof for discharging an outflow of filtered liquid. The filter unit is mounted vertically in the filter housing by means of the mounting means. The prefilter further comprises:

- a reception chamber in the filter housing in fluid communication with the inlet of the housing and with the inlets of the filter unit, the liquid to be filtered entering the housing via the inlet thereof and flowing across the reception chamber to enter the inlets of the filter unit; and

- a discharge chamber in the filter housing in fluid communication with the outlets of the filter unit and the outlet of the filter housing, the filtered liquid discharged at the outlets of the filter unit flowing across the discharge chamber towards the outlet of the filter housing.

According to a preferred feature of the invention, all the lamellar structures are similar and have the shape of hollow truncated cones. Advantageously, this configuration of the lamellar structures, among other things, makes it easier to stack the same on top of each other.

Also preferably, the inlet of each of the passages is located on the lower end side of the respective lamellar structures and the outlet is located on the upper end side of the respective lamellar structures, whereby the flow of liquid in the passages is ascendant and the particulate matters retained by the filtering means, which is preferably an overflow dam wall, accumulate on the lower side of the lamellar structures. Thus, such preferred configuration allows the particulate matter accumulated behind the filtering means of each lamellar structure to detach from the lamellar structure and to fall down by gravity into the reception chamber.

According to a preferred embodiment of the invention, each of the lamellar structures in the form of hollow truncated cones has an outer peripheral edge and an inner edge smaller than the outer peripheral edge, the outer peripheral edge being the upper end side of the lamellar structure and the inner edge being the lower end side of the lamellar structure, whereby the reception chamber of the prefilter is located in a central zone of the filter unit and the discharge chamber is located all around the same.

According to a further preferred embodiment of the invention, each of the lamellar structures in the form of hollow truncated cones has an outer peripheral edge and an inner edge smaller than the outer peripheral edge, the outer peripheral edge being the lower end side of the lamellar structure and the inner edge being the upper end side of the lamellar structure, whereby the reception chamber of the prefilter is located all around the filter unit and the discharge chamber is located in a central zone of the same.

Also preferably, the latter preferred embodiment comprises an upper filter unit located in the top portion of the housing on top of the filter unit, hereinafter referred to as the lower filter unit, for further filtering liquid previously filtered in the lower filter unit. The upper filter unit comprises:

- superposed and spaced-apart truncated hollow cones similar in shape and size to the truncated cones of the lower filter unit and being in registry with the same, the

upper filter unit having a lowermost truncated cone superposed on an uppermost truncated cone of the lower filter unit, the hollow truncated cones of the upper filter unit having an upper inner edge and a lower outer peripheral edge, the upper filter unit having a centrally located zone on top of the centrally located zone of the lower filter unit;

- a passage for a flow of liquid between each two of the spaced-apart truncated cones having an inlet at the upper inner edges thereof for receiving an inflow of liquid to be filtered and an outlet at the lower outer peripheral edges thereof for discharging an outflow of filtered liquid; and

- filtering means in each of the passages for obstructing the flow of liquid and retaining particulate matter contained in the liquid.

In this case, the prefilter further comprises:

- a reception chamber for the upper filter unit located in the centrally located zone thereof, the reception chamber being in fluid communication with the discharge chamber of the lower filter unit and with the inlet of each of the passages of the upper filter unit;

- a discharge chamber for the upper filter unit located in the top portion of the filter housing all around the upper filter unit, the discharge chamber being in fluid communication with the outlet of each of the passages of the upper filter unit and with the outlet of the housing; and

- means for hermetically separating the reception chamber of the lower filter unit and the discharge chamber of the upper filter unit.

Preferably, in order to better control the flow of liquids entering the filter housing, any of the preferred embodiments of the invention may further comprise an inlet chamber extending at the bottom end of the filter housing. Such inlet chamber is in fluid communication with the reception chamber of the filter housing via an outlet of the inlet chamber hermetically connected to the inlet of the filter housing. The inlet chamber further has a sidewall provided with a plurality of slots sized and shaped for receiving and prefiltering a liquid to be filtered, whereby the liquid to be filtered enters the inlet chamber via the slots thereof and then flows across the inlet chamber and upwardly in the reception chamber of the filter housing.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will become more apparent upon reading the detailed description and upon referring to the drawings in which :

Figure 1 is a cross-sectional side view of a prefilter according to a first preferred embodiment of the invention.

Figure 2 is a perspective view of a lamellar structure in the form of a hollow truncated cone used to build the filter unit of the prefilter of figure 1.

Figure 3 is a schematic cross-sectional side view of the prefilter of figure 1 showing the flow of liquids therein.

Figure 4 is a perspective view of a housing used in a second and third preferred embodiment of the invention.

Figure 5 is a schematic cross-sectional side view of a prefilter according to the second preferred embodiment of the invention showing the flow of liquids therein.

Figure 6 is a schematic cross-sectional side view of the prefilter according to a third preferred embodiment, showing the flow of liquids therein.

Figure 7 is an exploded view of the prefilter of figure 6.

Figure 8 is a perspective view of a lamellar structure in the form of a hollow truncated cone used to built the filter unit of the prefilter of figure 6.

Figure 9 is a top view of the lamellar structure of figure 7.

DETAILED LIST OF THE ELEMENTS WITH THE NUMERAL REFERENCES

2	prefilter
4	filter unit
6	filter housing
8	inlet of the filter housing
10	bottom portion of the filter housing
12	outlet of the filter housing
14	top portion of the filter housing

16	lamellar stuctures including hollow truncated cones
18	lower end side of the lamellar structures
20	upper end side of the lamellar structures
22	passage
24	inlet of the passage
26	outlet of the passage
28	overflow dam wall
29	top edge of the dam wall
30	reception chamber
32	discharge chamber
34	inlet structure
36	outlet of the inlet structure
38	sidewall of the inlet structure
40	slots of the inlet structure
42	linear filtration interstices
44	tab of the conical lamellar structure
46	tab receiving element
48	end of the tab
50	top end of the filter housing
52	cover of the housing
54	hanger for the filter unit
56	lower portion of the hanger
58	brackets of the hanger
60	bottom wall of the filter housing
62	extra outlet of the filter housing
64	outlet pipe
66	annular restriction
68	outlet chamber
70	watertight liner
72	inside rim
80	upper filter unit
82	centrally located zone
84	reception chamber of the upper filter unit
86	discharge chamber of the upper filter unit
88	vertical slots in the dam wall

While the invention will be described in conjunction with example embodiments, it will be understood that it is not intended to limit the scope of the invention to such embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included as defined by the appended claims.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the following description, similar features in the drawings have been given similar reference numerals and in order to lighten the figures, some elements are not referred to in some figures if they were already identified in a precedent figure.

Referring to figures 1, 5 and 6 and broadly described, either one of the preferred embodiments of the invention concerns a prefilter (2) comprising a filter unit (4) mounted vertically in a filter housing (6).

The filter housing (6) has an inlet (8) in a bottom portion (10) thereof for receiving an inflow of liquid to be filtered and an outlet (12) in a top portion (14) thereof for discharging an outflow of filtered liquid.

The filter unit (4) for each of these preferred embodiments has the following common characteristics. It comprises superposed and spaced-apart inclined lamellar structures (16) each having a lower end side (18) opposite an upper end side (20). As can be appreciated, a passage (22) for a flow of liquid is defined between each two of the lamellar structures (16). Each passage (22) has an inlet (24) for receiving an inflow of liquid to be filtered and an outlet (26) for discharging an outflow of filtered liquid. The filter unit (4) further comprises filtering means in each of the passages (22) for obstructing the flow of liquid and retaining particulate matter contained in the liquid. The filtering means is preferably an overflow dam wall (28), as best shown in either figures 2 or 8.

The prefilter (2) also comprises a reception chamber (30) in the filter housing (6) in fluid communication with the inlet (8) of the housing (6) and with the inlets (24) of the filter unit (4). The liquid to be filtered enters the housing (6) via the inlet (8) thereof and is flowing across the reception chamber (30) to enter the inlets of the filter unit (24).

The prefilter (2) further comprises a discharge chamber (32) in the filter housing (4) in fluid communication with the outlets (26) of the filter unit (4) and the outlet (12) of the filter housing (6). Therefore, the filtered liquid discharged at the outlets (26) of the filter unit (4) is flowing across the discharge chamber (32) towards the outlet (12) of the filter housing (6).

Such prefilters (2), although not limited to that specific use, may advantageously be used at the outlet of a septic tank in order to limit the charge of particulate matters to treat at the purifying element following the septic tank. A prefilter (2) according to the invention may also be suitable for use with any tank having an outlet for discharging a liquid containing particulate matters.

According to a preferred feature of the invention, all the lamellar structures (16) are similar and have the shape of hollow truncated cones, as best shown in figures 2 and 8. Advantageously, this configuration of the lamellar structures (16), among other things, makes it easier to stack the same on top of each other.

It is however worth noting that the lamellar structures (16) of the filter unit are not limited to that conical configuration. They could have the shape of inclined discs or any other shape as long as they have an inclined surface once superposed with other like lamellar structures.

Also preferably and as shown in figures 1, 5 and the bottom portion of figure 6, the inlet (24) of each of the passages (22) is located on the lower end side (18) of the respective lamellar structures (16) and the outlet (26) is located on the upper end side (20) of the respective lamellar structures (16), whereby the flow of liquid in the passages (22) is ascendant and the particulate matters retained by the dam walls (28) accumulate on the lower side of the lamellar structures (16). Thus, such preferred configuration allows the particulate matters accumulated behind the dam walls (28) of each lamellar structure (16) to detach from the same and to fall down by gravity into the reception chamber (30). It also allows an easy cleaning of the structure with a jet of water.

The approach of the preferred embodiments of the invention shown in either one of figures 1, 5 or 6 is based on the following hydraulic and physical principles: the water enters the filter housing (6) preferably via an inlet structure (34) extending at the bottom end of the filter housing (6), which inlet structure (34) will be described hereinafter. After that, the water flows vertically in the reception chamber (30) which is either a cylindrical zone at the centre of the filter unit (4), as in the first preferred embodiment shown in figure 1, or a peripheral zone, as in the second and third preferred embodiments shown in figures 5 and 6. Thus, in the first preferred embodiment, the water flows from the inside towards the outside of the filter unit (4), and in the second and third embodiments, the water flows from the outside towards the inside of the filter unit. The reception chamber (30) is formed by the superposition of the lamellar structures (16), preferably having the shape of a hollow truncated cone. The stacked lamellar structures (16) form a series of channels or passages (22) inclined with respect to the horizontal where the water circulates following an ascending radial trajectory, from the centre towards the perimeter or from the perimeter towards the centre.

The inlet structure (34) extending at the bottom end of the filter housing (6) is in fluid communication with the reception chamber (30) of the filter housing (6) via an outlet (36) of the inlet chamber (34) hermetically connected to the inlet (8) of the filter housing (6). The inlet chamber (34) has a sidewall (38) provided with a plurality of slots (40) sized and

shaped for receiving and prefiltering liquid to be filtered, whereby the liquid to be filtered enters the inlet chamber (34) via the slots (40) thereof and then flows across the inlet chamber (34) and upwardly in the reception chamber (30) of the filter housing (6). The inlet chamber (34), which preferably has a nozzle shape, limits the carry over of fine particles associated with gas bubbles and ensures a better control of the velocity of the liquids entering the filter housing (6). More specifically, it can ensure a velocity of liquids inferior to 0.6 cm/s in order to limit the carry over of the heavier solids.

The outlet (36) of the inlet structure (34) can be designed so as to be screwable to the inlet (8) of the filter housing (6) or it could also be integrally formed with the filter housing.

DETAILED DESCRIPTION OF EACH PREFERRED EMBODIMENT

Description of the first preferred embodiment

Referring to figures 1 to 3, in the first preferred embodiment of the invention, each of the lamellar structures (16) in the form of hollow truncated cones has an outer peripheral edge and an inner edge smaller than the outer peripheral edge. A single truncated cone (16) is shown in figure 2. The outer peripheral edge corresponds to the upper end side (20) of the lamellar structure (16) and the inner edge to the lower end side (18) of the lamellar structure (16), whereby the reception chamber (30) of the prefilter (2) is located in a central zone of the filter unit (4) and the discharge chamber (32) is located all around the same, as best shown in figure 3.

Turning now to figure 2, each of the truncated cones (16) has an overflow dam wall (28) extending upright from an upper surface thereof. The dam wall (28) has a top edge (29) and a height sized so that the top edge (29) is spaced apart from the underside surface of an upwardly adjacent cone (16) once stacked in a pile with like cone (16), as best shown in figure 3. A linear filtering interstice (42) is thus formed between the top edge (29) of the dam wall (28) and the underside surface of an upper lamellar structure (16). In order to increase the filtering capacity of the filter unit (4), the overflow dam wall (28) in each of the passages (22) has a sinuous path.

The filter unit (4) also comprises linking means for linking the conical lamellar structure (16) one to another in superposition. The linking means preferably comprises a plurality of tabs (44) extending vertically from the inner edge of each truncated cone (16), that is to

say in this case from the lower end side (18) thereof, and a plurality of tab receiving elements (46) in the inner edge of each truncated cone (16), each tab receiving element (46) being shaped for interconnection with a tab (44) of another truncated cone (16). More specifically, each of the tabs (44) has an end (48) in the form of a hook and each of the tab receiving elements (46) is in the form of a vertical groove into which a tab (44) of another truncated cone (16) is slidably insertable.

As best shown in figure 1, the filter housing (6) is preferably tubular and comprises an open top (50) and a cover (52) adapted to hermetically fit on the open top (50) of the filter housing (6). A hanger (54) is mounted in the cover (52) for suspending the filter unit (4) in the filter housing (6). The hanger (54) preferably has a lower portion (56) for extending downwardly in the filter housing (6) and brackets (58) at the lower portion (56) connectable to an uppermost truncated cone (17) of the filter unit (4).

Also preferably, the filter housing (6) comprises a conical bottom wall (60) with a central opening consisting of the inlet (8) of the filter housing (6). The filter unit (4) is thus mounted vertically in the filter housing (6) by simply introducing the same in the filter housing (6) via the open top end (50) thereof. The filter unit (4) may then be supported by the conical bottom wall (60) of the filter housing (6).

The cover (52) and the top end (50) of the filter housing (6) are shaped so as to be screwable one to each other.

As can be appreciated, the filter housing (6) may advantageously comprise a closable extra outlet (62) in the top portion (14) thereof. This extra outlet (62) can be used for linking a prefilter (2) with another like prefilter.

Considering now the ascending slope of the passages (22) between the lamellar structures (16), the decantation phenomenon of the particles, which is the principle of lamellar decantation, and the biological coalescence of fine particles, which is the result of agglutination by the micro-organisms of fine particles into matter that can be decanted, can therefore take place. The spacing between the top edge (29) of the dam wall (28) and the following conical element (16) creates the linear interstice (42) whose thickness is sized as a function of the size of the particles to retain. With time, the decanted matters accumulate and a biological film develops at the level of the interstice (42) and on the

inclined walls of the cone (16). When the quantity of accumulated matters reaches a certain thickness, there may be detachment of those matters, because of the ascending slope of the structure. These matters can then go back into the septic tank by the entrance structure. Furthermore, it is possible that certain fine particles may be released before the detachment of the film, but they cannot reach the effluent of the tank, because they would have to go through the interstices sized in function of the size of the particles to retain and placed on the downstream side of the wall (28). The flow and the retention of the particles are therefore managed by a downstream type control.

As can be appreciated, in the embodiment illustrated in figures 1 and 3, the water flows vertically in the reception chamber (30) located in the open central part of the filter unit (4) and formed by the superposition of the conical lamellar structures (16). The water then flows in the discharge chamber (32) located all around the filter unit (4). Then, it is evacuated through the outlet (12) of the housing (6) located in the top portion (14) thereof and directed towards the outlet orifice of the septic tank (not illustrated) via an outlet pipe (64).

Description of the second and third preferred embodiments

The more detailed description of the second and third embodiments will now be made by referring to figures 4 to 9.

As can be appreciated in figures 5 and 6, and contrary to the first preferred embodiment, the conical lamellar structures (16) forming the filter unit (4) of the second and third preferred embodiments are disposed such that their outer peripheral edge corresponds to the lower end side (18) of the lamellar structure (16) and that the inner edge corresponds to the upper end side (20), whereby the reception chamber (30) of the prefilter (2) is located all around the filter unit (4) and the discharge chamber (32) is located in a central zone of the filter unit (4).

As shown in figure 4, the filter housing (6) for both embodiments comprises an annular restriction (66) separating the bottom and top portions (10,14). Turning now to figure 5, the filter unit (4) of the second preferred embodiment is located in the bottom portion (10) of the filter housing (6) and the discharge chamber (32) is in fluid communication with the outlet (12) of the filter housing (6) via an outlet chamber (68) located in the top portion

(14) of the filter housing (6). The prefilter (2) further comprises an annular watertight liner (70) mounted on an inside rim (72) formed by the restriction (66). The liner (70) is used to hermetically seal the joint between the outlet chamber (68) and the reception chamber (30) of the filter housing (6).

Referring now to figures 6 and 7, the third preferred embodiment comprises an upper filter unit (5) located in the top portion (14) of the housing (6) on top of the filter unit (4) previously described and hereinafter referred to as the lower filter unit (4). The upper filter unit (5) is used for further filtering liquid previously filtered in the lower filter unit (4). The upper filter unit (5) comprises superposed and spaced-apart truncated hollow cones (16) similar in shape and size with the truncated cones (16) of the lower filter unit (4) and being in registry with the same. The upper filter unit (5) has a lowermost truncated cone superposed on an uppermost truncated cone of the lower filter unit (4). The upper filter unit (5) has a centrally located zone (82) on top of the centrally located zone of the lower filter unit (4).

As for the lower filter unit (4), a passage (22) for a flow of liquid is formed between each two of the spaced-apart truncated cones (16) of the upper filter unit (5). Each of the passages (22) has an inlet (24) at the upper end side (20) of the conical lamellar structure (16) for receiving an inflow of liquid to be filtered and an outlet (26) at the lower end side (18) thereof for discharging an outflow of filtered liquid, whereby the water flowing in the upper filter unit (5) follows a descending path. Also, a filtering means is provided in each of the passages (22) for obstructing the flow of liquid and retaining particulate matter contained in the liquid. Preferably, the filtering means in each passage is an overflow dam wall as described above.

It has to be noted that in another preferred embodiment, not illustrated, the hollow truncated cone of the upper filter unit may be set with the inner edge of the cone as the lower end side of the control lamellar structure. Each of the passages would then have its inlet at the lower end side of the lamellar structure, whereby the water flowing in the upper filter unit would follow an ascending path.

The prefilter (2) according to the third preferred embodiment further comprises a reception chamber (84) for the upper filter unit (5) located in the centrally located zone (82) thereof. The reception chamber (84) of the upper filter unit (5) is in fluid

communication with the discharge chamber (32) of the lower filter unit (4) and with the inlet (24) of each of the passages (22) of the upper filter unit (5).

A discharge chamber (86) is also provided for the upper filter unit (5). It is located in the top portion (14) of the filter housing (6) all around the upper filter unit (5) and it is in fluid communication with the outlet (26) of each of the passages (22) between the spaced-apart truncated cones (16) and with the outlet (12) of the housing (6). An annular watertight liner (70) is provided on the inside rim (72) of the housing (6) formed by the restriction (66) for hermetically separating the reception chamber (30) of the lower filter unit (4) and the discharge chamber (86) of the upper filter unit (5).

Referring now to figures 8 and 9, a preferred version of a hollow truncated cone (16) that can be used with the second and third preferred embodiments is illustrated. As for the embodiment shown in figure 3 already describes, it comprises an overflow dam wall (28) extending upright from an upper surface thereof. As can be appreciated, in order to further increase the filtering capacity of such dam wall (28), the top edge (29) of the dam wall (28) has a corrugated relief and a plurality of vertical slots (88) are provided along the wall (28).

The remaining characteristics of the second and third preferred embodiments are substantially identical to the characteristics already described in reference to the first embodiment.

Advantageously, the inclined configuration of the lamellar structure allows to increase the length of the linear filtration interstice formed with the dam wall and thus greatly increases the filtration capacity of the filter unit in comparison to a flat structure, such as it is described in the American patents nos. 2,900,084; 3,332,552; 4,710,295; 5,582,716 and 5,593,584. Also, the addition of vertical slits, perpendicular to the plane of the conical elements, allows to increase the total interstitial surface available for filtration. As an example, a prefilter according to the invention, of the hollow conical truncated type, as illustrated in figure 3, with a circular section of 20 cm in diameter, presents an interstitial surface comparable to what is observed with prefilters of horizontal planar structures of 30 cm presently on the market (1080 cm^2 for the 20 cm truncated cone type vs 958 cm^2 for the 30 cm). Whereas, a prefilter according to the present invention, as illustrated in figure 5, with a circular section of 18,75 cm in diameter, presents an interstitial surface

comparable to that observed with prefilters with planar horizontal structures of 30 cm currently on the market (645 cm^2 of useful surface for the 18,75 cm truncated type cone vs 700 cm^2 for the 30 cm).

It is also worth noting that the detachment of the particles and the biological film accumulated allows to reduce the number of cleanings and facilitates them. In fact, the detachment of the accumulated material is accentuated by the natural wiping and dripping phenomenon resulting from the removal of the filtering structure from the water.

The inclined configuration of the lamellar structure also eases the cleaning operation of the filter unit with a jet of water.

The inclination of each element can either be towards the interior or towards the exterior, depending on the chosen direction of the flow (from the centre to the perimeter or from the perimeter to the centre).

Although preferred embodiments of the present invention have been described in detail herein and illustrated in the accompanying drawings, it is to be understood that the invention is not limited to these precise embodiments and that various changes and modifications may be effected therein without departing from the scope or spirit of the present invention.